GRANULAR AGGREGATE RESOURCES
BLACKVILLE MAP-AREA (N.T.S. 21 I/12) NEW BRUNSWICK

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ABSTRACT

This report provides an evaluation of the distribution, extent, thickness, and quality of surficial granular aggregate deposits in the Blackville (21 I/12) map-area. The major aggregate deposits are outlined on the accompanying map, while the report outlines the mode of origin of the deposits and their general characteristics. Quality test results and calculated reserve volumes are also presented.

All of the regionally significant granular aggregate reserves are associated with a large, discontinuous ice-contact system, and associated outwash deposits, which extend down the Southwest Miramichi River valley from Blackville to the mouth of Black Brook, and from thence east beyond Despres Lake. Total reserves in these deposits are estimated to exceed 43 million m^3. A large proportion of this material comprises very poor to poor quality coarse aggregate. However, extensive reserves of fair to excellent quality fine aggregate are present. Minor sources of similar aggregate are present elsewhere within the map-area.

In addition to the above deposits, extensive resources of borrow material are present throughout the map-area. However, no attempt has been made to calculate the reserves of these aggregate sources, due to their very poor quality and ready availability.

RESUME

Le présent rapport consiste en l'évaluation de la répartition, la quantité, l'épaisseur et la qualité des dépôts superficiels d'agrégat granulaire que l'on trouve dans la région cartographique de Blackville (21 I/12). Les dépôts d'agrégat les plus importants sont délinéés sur la carte en annexe, tandis que le rapport expose les grandes lignes du mode d'origine de ces dépôts et de leurs caractéristiques générales. Les résultats des tests de qualité et les volumes approximatifs des réserves sont également donnés.

Toutes les réserves d'agrégat granulaire ayant une certaine importance au niveau régional sont associées à un vaste système de contact glaciaire discontinu ainsi qu'aux dépôts fluvioglaciaires correspondants, qui descendent jusqu'au sud-ouest de la vallée de la rivière Miramichi depuis Blackville jusqu'à l'embouchure du ruisseau Black et de là s'étendent à l'est, au-delà du lac Despres. Il est estimé que les réserves totales de ces dépôts excèdent 43 millions de mètres cubes. Une grande partie de ces matières comprennent de l'agrégat grossier de qualité très pauvre à pauvre. Toutefois, de grandes réserves d'agrégat fin de qualité allant de passable à excellente s'y trouvent également. De plus petites sources d'agrégat semblable se trouvent à d'autres endroits à l'intérieur de la région cartographique.

En plus des dépôts mentionnés ci-dessus, de grandes ressources de matériau d'emprunt se trouvent partout dans la

région cartographique. Toutefois, rien n'a été tenté pour calculer les réserves de ces sources d'agrégat en raison de leur très pauvre qualité et des grandes quantités actuellement disponibles.

TABLE OF CONTENTS

	Page
ABSTRACT	i
RESUME	ii
INTRODUCTION	1
Location of the Study Area	1
The Present Study	1
Summary of Previous	4
PHYSIOGRAPHY, BEDROCK GEOLOGY AND DRAINAGE	5
Physiography	5
Bedrock Geology	5
Drainage	6
SURFICIAL GEOLOGY	8
Glaciation	8
Deglaciation	9
Submergence	10
Postglacial Events	11
GRANULAR AGGREGATE RESOURCES	13
Description of Map Units	13
1) Ice-Contact Stratified Drift	13
2) Glaciofluvial Outwash	14
3) Ancient Alluvium	14
Quality Limitations	15
1) Textural Characteristics	15
a) Fine Particle Content	17
b) Grading	17
2) Lithologic Characteristics	19
Major Aggregate Sources	21
1) Despres Lake Esker	21
2) Ice-Contact/Outwash Complex	23
3) Blackville Ice-Contact Deposits	24
Minor Aggregate Deposits	25
1) Ice-Contact Stratified Drift	26
2) Glaciofluvial Outwash	27
3) Ancient Alluvium	28
4) Sand Veneer Deposits	29
5) Modern Alluvium	29
6) Till and Weathered Bedrock	30
7) Ablation Till	30
CONCLUSIONS	32
REFERENCES	33

Table of Contents (continued)

		Page
Table I.	Grain Size Classification	16
II.	Textural Classification	18
III.	Grading Limits For Fine Concrete Aggregate	20
Figure 1.	Map showing the location of the Blackville map-area.	2
Appendix	Sample Descriptions of Blackville map-area 21 I/12	36
Plate 83-31	Granular Aggregate Resources of Blackville 21 I/12	in pocket

INTRODUCTION

LOCATION OF THE STUDY AREA

The Blackville (21 I/12) map-area covers an area of approximately 1050 km^2 in east-central New Brunswick. This area is bounded by Longitudes 65°30' and 66°00' west, and by Latitudes 46°30' and 46°45' north (Figure 1). The village of Blackville is the major community within this area.

Provincial Highway 8 passes through the western half of the map-area. Several local roads, and numerous lumber roads, are also present. While access to some areas is nonexistent, all of the significant aggregate deposits are readily accessible.

THE PRESENT STUDY

The objective of this study is to provide basic information pertaining to the location, extent, thickness and quality characteristics of the granular aggregate deposits in the Blackville area. As such, it comprises part of a province-wide inventory of granular aggregate resources.

Fieldwork was undertaken during the summer and fall of 1982. This involved the examination of man-made and natural exposures throughout the study area, and the description and sampling of representative sections. For those deposits with a significant gravel content, a sample of approximately 100 pebbles in the 25 to 50 mm size range was collected from a fresh exposure. In the lab, the lithological identities of the pebbles were determined, and rated for "soundness" (see "Lithologic characteristics", p. 19), so as to give a general idea as to the quality of the

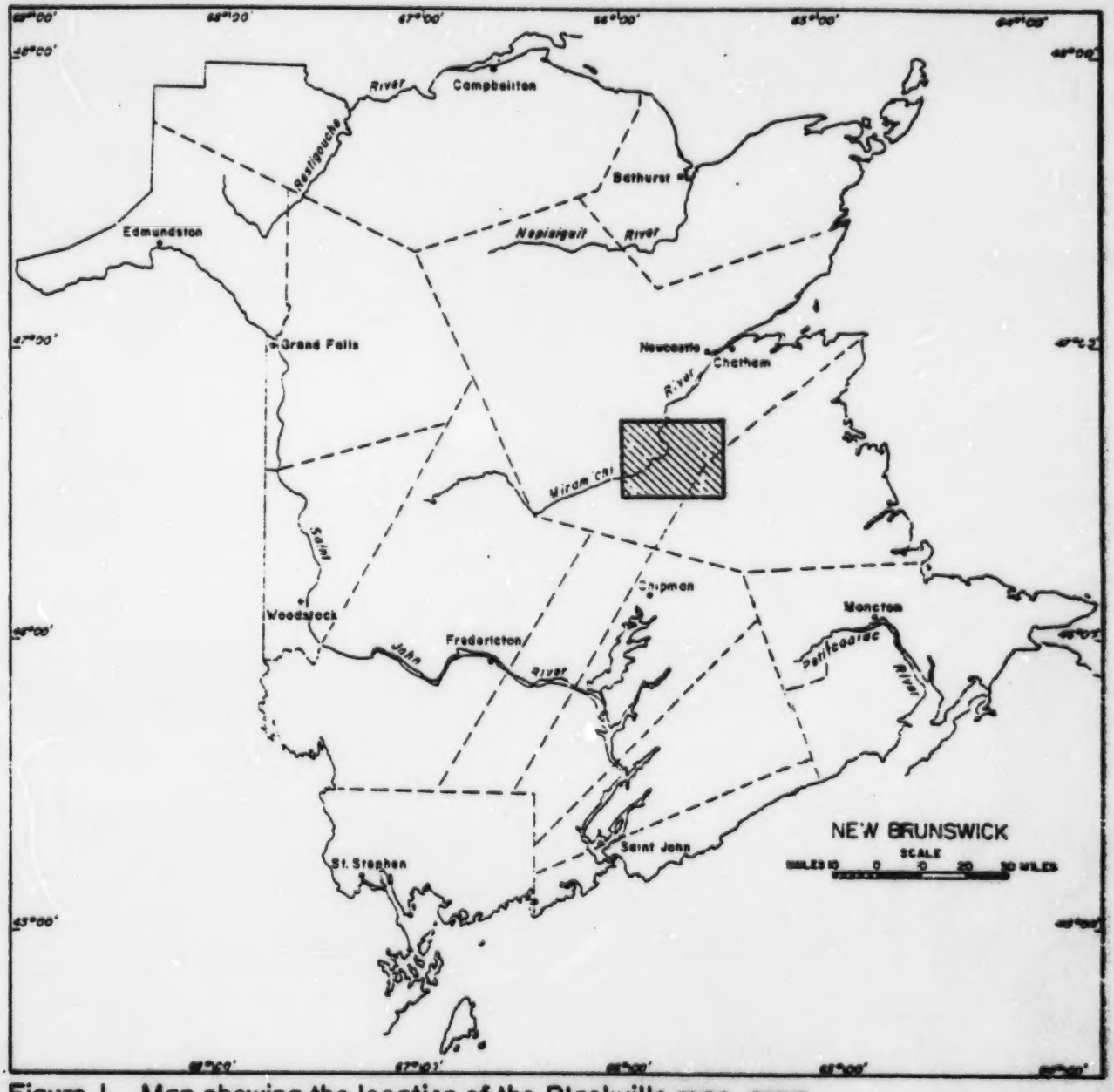

Figure 1. Map showing the location of the Blackville map-area

gravel.

Bulk samples were also collected from the same sites. Samples weighing from 1 to 26.5 kg were obtained, the size of the sample being dependent upon the percentage of gravel in the material and its coarseness. Multiple samples were taken from those deposits which exhibited significant textural variability. The grain size distributions of these samples were determined using standard sieving techniques (as per A.S.T.M. C136-76) by the New Brunswick Department of Transportation, with the silt and clay fraction being determined by means of the wet sieving technique (A.S.T.M. C117-76).

The results of the sample analyses, and the section descriptions, are tabulated on the data sheets contained in the Appendix. This information is supplemented by quality test information from unpublished Department of Transportation (D.O.T.) aggregate test reports, where available. Comments pertaining to the general characteristics of the deposit as a whole are also included.

Reserve estimates are based on field observations, supplemented, when possible, by Department of Transportation test results. Aerial photograph interpretation was used as a supplement to the fieldwork, particularly in the interpretation of the extent of the deposits. Average workable thickness figures were derived by projecting section heights observed in pit sections and in other natural and man-made exposures to areas beyond the exposures, based on geologic and topographic considerations. The estimated workable area is that area which is not subject to

obvious physical restrictions (i.e. the presence of highways, buildings, boggy areas, etc.).

SUMMARY OF PREVIOUS WORK

Some aspects of the surficial geology of the study area were outlined by Chalmers (1885, 1895) in his early work on the surficial geology of New Brunswick. The most significant information is found in his striation observations and inferred ice flow directions, though he also provides interesting comments pertaining to glacial history. More recently, a report outlining the regional surficial geology of the Moncton 1:250,000 map-area, which encompases the study area, was completed (Rampton and Paradis, 1981).

A preliminary investigation of the aggregate potential of the Despres Lake esker (Rogersville esker), in the eastern portion of the map-area, has been previously published (Chandra et al., 1975; Kingston, 1974a, 1974b). This investigation included a hammer seismic survey, and the sampling and analysis of the aggregate from several sites along the esker. Unfortunately, due to discrepancies between the map (Kingston, 1974a) and the report (Kingston, 1974b), the precise location of the sample sites cannot be determined. However, the seismic information is useful, giving as it does an accurate figure for workable thickness at given locations.

In addition to the above information, limited information on a few other aggregate extraction sites within the study area has been reported by Hamilton and Carroll (1975) in their preliminary survey of the aggregate resources of the province.

PHYSIOGRAPHY, BEDROCK GEOLOGY, AND DRAINAGE

PHYSIOGRAPHY

The Blackville area lies within the New Brunswick Lowlands portion of the Maritime Plain (King, 1972), which is a division of the Appalachian physiographic region of eastern Canada (Bostock, 1970). These lowlands consist of a broad, relatively smooth, undulating plateau surface (Bird, 1972) that slopes gently northeastwards towards Northumberland Strait (Bostock, 1970), or, as succinctly described by Chalmers (1895, p. 8), a "flat and uninteresting plain". However, along the major streams, which are incised into this plain, the local relief is in the order of 30 to 60 m.

BEDROCK GEOLOGY

The bedrock immediately underlying the Blackville map-area comprises sedimentary rocks of Pennsylvanian age or younger (Potter et al., 1979). These rocks consist predominantly of grey to brown, locally reddish, sandstones and minor pebbly sandstones, though interstratified red and green shales have been observed at a few localities in the eastern part of the map-area.

In general, the upper 1 to 1.5 m of the sandstone is weathered, the resulting material comprising a rubble of blocks or slabs. Chalmers (1895, 1898) indicated that the disintegration of the bedrock surface was due to pre-glacial weathering. However, Rampton and Paradis (1981) note that this need not necessarily be the case. It is quite possible that this disintegration was due to frost action in the periglacial zone

during late-glacial times. In support of this interpretation is the fact that striations were observed on the surface of a flaggy, shattered sandstone adjacent to a small quarry just to the south of the study area.

The physical characteristics of the weathered sandstone are such that, without a clean vertical exposure that exhibits the bedding characteristics, it is difficult to differentiate it from a sandy, stony till - a characteristic also noted by Rampton and Paradis (1981).

DRAINAGE

The surface of the Blackville area exhibits a glacially deranged drainage pattern superimposed on a southwest-northeast trending rectilinear pattern, which appears to be of preglacial origin. Ice-scouring and drift deposition appear to have caused the partial divergence of the major streams from their preglacial channels. It also created a multitude of enclosed basins of varying size, now occupied by bogs or small, boggy lakes.

The preglacial drainage of the area appears to have been via three major, and one minor, parallel systems, which in turn extend parallel to a major valley to the northwest, now occupied by the underfit Dungarvon River. The four drainage systems within the area appear to have been as follows: 1) via the Bartholomew River valley and the northern segment of the Southwest Miramichi valley; 2) via the western portion of the Southwest Miramichi valley and the Black Brook valley; 3) via the Cains River and Salmon Brook valleys; and finally, 4) via various segments and

tributaries of the East and West Sabbies Rivers. The latter three systems appear to have connected with various branches of what is now the Barnaby River system. The effects of glacial activity appear to have diverted system 4 into system 3, 3 into 2, and 2 into 1, probably along a zone of weakness in the bedrock, defined by a north-northwest trending basement structure outlined by Fyffe et al. (1982). In addition to these major divergences, several minor divergences appear to be present along the western part of the Southwest Miramichi valley, and one along the Cains River near the base of the map-area. Information from a well drilled at Molasses Hill (Department of the Environment files), indicates that 27 m of overburden is present in an abandoned preglacial channel.

Drainage of the Blackville area is now primarily northward, via the Southwest Miramichi River and its tributaries, the most important of which are the Bartholomew, Cains, East and West Sabbies, and Middle Barnaby Rivers. However, in the poorly-drained southeastern corner of the map-area a multiple drainage divide is present, forming the boundaries between the Miramichi, Saint John, and Northumberland drainage basins. From this area, waters flow northwestward into the Sabbies River system, southward into the Salmon River system (tributary to the Saint John River), and eastward into the Kouchibouguac and Kouchibouguacis River systems (Northumberland drainage).

SURFICIAL GEOLOGY

GLACIATION

The widespread distribution of till and glacial erratics throughout the Blackville map-area, and the local occurrence of glacially smoothed and striated outcrops, indicates that the area has been completely glaciated at some time in the past. Rampton and Paradis (1981) indicate that these features relate to glaciation during Late Wisconsinan time. Other than the apparent traces of the preglacial drainage system, mentioned previously (see "Drainage"), no evidence for features or events of earlier age has been observed.

Due to the generally shattered nature of the bedrock surface in the study area, striations and other small-scale indicators of ice-flow direction are rare, with only ten striated surfaces having been observed (seven in the western half of the area). Of these, eight record ice-flow in a northerly to northeasterly direction. The remaining two, both in the eastern portion of the map-area, diverge from the others by approximately 90°. While the sense of the ice-flow direction could not be determined at these two sites, the orientation of similar features from this general area reported by Chalmers (1895) indicates that they relate to easterly to southeasterly flow. Rampton and Paradis (1981) indicate that the latter striations predate the others, and relate to ice flowing from a source to the west (during the Caledonia, Chignecto, and Kent phases). Subsequently, with waning of the ice (during the Bantalor phase), a ridge of ice (the

Gaspereau ice centre) to the southwest became dominant, leading to ice flow in a more northerly direction (Rampton and Paradis, 1981).

Subsequent to the striation of the Carboniferous sandstones an almost ubiquitous blanket of lodgement till was laid down. This material rarely exceeds 1 to 1.5 m in thickness (as has also been indicated by Rampton and Paradis, 1981). In the fresh sate, it comprises a dense to very dense, reddish-brown, clayey sand to clayey stony sand till. However, postglacial soil development, extending to a maximum depth of approximately 0.5 m, has resulted in the formation of a surface horizon of brown silty to silty stony sand.

DEGLACIATION

According to Rampton and Paradis (1981), deglaciation of the Blackville area began during the Kent phase, during the waning stages of which the Despres Lake esker was formed. They indicated that this occurred approximately 18,500 years Before Present (y.B.P.), based on a whale bone found in marine clays near Saint-Louis-de-Kent. Subsequently, during the Bantalor phase, the northerly flowing ice stopped short of the Despres Lake esker (Rampton and Paradis, 1981).

However, based on the information now available, the above interpretation appears untenable. Firstly, a northerly trending striae is present only 5 km to the south of the esker, and yet there is no evidence of an east-west trending ice margin in this area. Secondly, the beaded nature of the esker, and the orientation of the ablation moraine ridges, indicates that ice

retreat was towards the west. Finally, the presence of the discontinuous esker system to the southeast of the Sabbies Rivers, and the increase in sandstone content from north to south in the ice-contact deposits extending from Renous to Keenan Siding, suggest that meltwater was funnelling into the Despres Lake esker system from both the north and the south, which in turn suggests the presence of a large, stagnant body of ice. Subsequent redating of the whale bone at 12,600 y.B.P. (GSC-3284, Rampton, written communication), which is within the time period of the Bantalor phase, supports the latter interpretation, since it removes the necessity of having the Despres Lake esker formed during the Kent phase. The northerly trend of the Bantalor ice flow does not preclude eastward retreat, since by the time retreat occurred the bedrock may have been protected from erosion by a veneer of till. Consequently, it seems that deglaciation of the Blackville area can be seen as less complex than envisaged by Rampton and Paradis (1981), involving only westward marginal retreat.

SUBMERGENCE

Rampton and Paradis (1981) suggest that, subsequent to deglaciation in this area, it was subject to marine submergence (though they note that in some areas these events may have been contemporaneous). These high marine levels in the Gulf of St. Lawrence have been defined by Elson (1969) as relating to the Goldthwait Sea.

Rampton and Paradis (1981) indicate that these waters

attained a level of at least 300 ft (91 m), and possibly 400 ft (122 m) in the Blackville area. In contrast, however, Gauthier (1978) indicates that submergence in this area was only in the order of 150 ft (45 m) to 175 ft (53 m). Similar figures to the latter have also been reported for this general area by Elson (1969) and Goldthwait (1912). Fairchild (1918) has reported submergence to 305 ft (93 m) near Rogersville; however, upon examination of the topographic map it becomes apparent that this figure is based on an error in altitude measurement of at least 100 ft (30 m).

The information acquired from the Blackville area indicates that submergence was not as high as reported by Rampton and Paradis (1981). Deep-water clays, and a possible beach ridge or bar, were observed at elevations below 200 ft (61 m). Associated irregular sand veneer deposits, inferred to be of shallow-water wave-wash origin, were observed to a maximum elevation of just above 200 ft (61 m). In addition, no evidence for wave reworking was noticed along the readily erodible margins of the Despres Lake esker, most of which lies between the 250 ft (76 m) and 300 ft (91 m) levels. Consequently, it appears that the marine submergence in the Blackville area only attained a level of approximately 200 ft (61 m).

POSTGLACIAL EVENTS

Subsequent to deglaciation (and submergence in those areas so affected), the newly exposed glacial deposits in the Blackville area were subjected to physical and chemical weathering, which also affected the upper surface of the underlying

bedrock. With emergence due to isostatic rebound, the streams began to re-excavate their drift-dammed preglacial valleys, though frequent divergences resulted (see: "Drainage"). The numerous depressions, and resultant poor drainage, on the extensive Carboniferous surface led to the formation of numerous lakes, which, over the years, have become filled with organic deposits, forming extensive boggy areas.

GRANULAR AGGREGATE RESOURCES

DESCRIPTION OF MAP UNITS

The major granular aggregate resources of the Blackville area are found in three basic deposits types. They are: 1) ice-contact stratified drift; 2) glaciofluvial outwash; and 3) ancient alluvium. A general characterization of each deposit type is given below.

1) Ice-Contact Stratified Drift: Ice-contact stratified drift deposits comprise those deposits formed when meltwater, flowing on, within, or against a glacier, deposits sediment in contact with the ice. Characteristically, these deposits form distinctive landforms. Within the Blackville map-area such deposits are represented by eskers and kames.

Eskers are linear accumulations of sediment formed either by deposition by meltwater streams flowing in channels or tunnels within a melting glacier (Flint, 1971), or by deposition of a series of overlapping fans or "beads" at the point of stream discharge from a retreating glacier (Embleton and King, 1975). Kames comprise mound-like hills, ranging from conical to irregular, formed from sediment which was washed into crevasses or other openings or depressions in the glacier surface, and left as mounds by the melting away of the ice (Flint, 1971).

Eskers are by far the predominant ice-contact features within the study area. Most significant is the large beaded esker which extends from the Miramichi River, near Howard (where it forms part of an extensive ice-contact/outwash complex), eastwards beyond Depres Lake. Minor, discontinuous, eskers elsewhere

in the map-area appear to be of subglacial tunnel origin, though esker fans are present in some areas.

In general, ice-contact stratified drift deposits consist primarily of sand and gravel, with variable quantities of clay, silt, cobbles and boulders. The sorting can vary from good to very poor, while the texture frequently exhibits abrupt lateral and vertical variations. Due to their deposition in contact with glacial ice, such deposits frequently exhibit postdepositional deformation structures due to slumping as the supporting ice melts away. Because of their intimate association with the glacier, pockets of ablation or lodgement till may be present.

2) Glaciofluvial Outwash: Glaciofluvial outwash comprises that material which is deposited beyond the margins of a glacier by the action of meltwater streams. In general, this material consists of well-washed, horizontally stratified sand, gravel, or combinations thereof. However, in the Blackville area, sand is predominant. Glaciofluvial outwash deposits generally exhibit a flat, gently sloping topography. However, the meltwater streams which form these deposits may transport, and deposit, blocks of ice in addition to their regular sediment load. The melting-out of buried ice blocks within the outwash deposits results in the formation of small circular to irregular depressions in the surface of the deposits, referred to as kettle holes (Flint, 1971).

3) Ancient Alluvium: Ancient alluvium comprises that material of fluvial origin, which was deposited subsequent to deglaciation, but which now lies above the level of modern

alluvial activity (except perhaps in the case of rare, extreme floods). These deposits include terraces formed along the major river valleys, and alluvial fans formed at the mouths of tributary streams. These deposits also consist of horizontally stratified sand or gravel, though they may also contain a significant silt component (usually in the form of discrete beds, commonly at the surface of the deposit). In general, alluvial fan deposits are coarser than alluvial terrace deposits within the same area.

QUALITY LIMITATIONS

The suitability of a granular aggregate deposit for various uses is a function of several quality limiting factors, which can be classified into two groups: 1) those related to the textural characteristics of the material; and 2) those relating to the lithologic characteristics of the component grains.

1) Textural characteristics: The textural characteristics of an aggregate are determined by passing a sample of the material through a nest of sieves (A.S.T.M. C136-76), and apply specifically to the sample examined. These characteristics can also be estimated in the field, on a qualitative basis. In this report, the grain size classification scheme outlined in Table I is utilized. In addition, the terms "fine aggregate" and "coarse aggregate" are used, to identify material finer and coarser, respectively, than 4.75 mm (A.S.T.M. C125-76).

The relative proportions of the different major grain size classes within a deposit, or a unit of a deposit, define the

TABLE I

GRAIN SIZE CLASSIFICATION

Descriptive Size Category		Limiting Size (Minimum)	Approximate Equivalent In D.O.T. Sieve Sizes (Not Passing)
Boulders		256 mm	-
Cobbles	- large	128 mm	-
	- small	64 mm	75 mm
Gravel	- very coarse	32 mm	31.5 mm
	- coarse	16 mm	19.0 mm
	- medium	8 mm	9.5 mm
	- fine	4 mm	4.75 mm
	- very fine	2 mm	2.36 mm
Sand	- very coarse	1 mm	1.18 mm
	- coarse	500 µm	600 µm
	- medium	250 µm	300 µm
	- fine	125 µm	150 µm
	- very fine	63 µm	75 µm
Silt and Clay (fines)		-	-

(Classification modified after Friedman and Sanders, 1978)

texture of the material. The terms used for textural classification in this report are shown in Table II, along with their approximate quantitative meaning.

There are two primary textural factors which may impose significant limitations on the potential of a granular aggregate deposit. These factors are: a) fine particle content; and b) grading.

a) Fine particle content: a content of fine particulate matter (that material passing through a 75 um sieve) in excess of 5 percent in an aggregate is generally considered deleterious, and for some usages, even lower percentages are specified (Bates, 1969). For example, D.O.T. (1980) specifications impose a limit of 3 percent on material to be used for fine concrete aggregate, and 1 percent for material to be used for coarse concrete aggregate.

Fine particles may occur as discrete beds within a deposit, as coatings on larger clasts, as disseminated particles throughout a deposit, or as some combination of the above. If an aggregate contains fines in excess of the specified limits for a particular use, it may be upgraded to an acceptable level by washing, with an attendant significant increase in the cost of exploitation. However, in the first case above, this may be avoided by selective extraction of material.

b) Grading: Grading refers to the particle size distribution within the aggregate (i.e. the relative proportions of material in the different size catagories). The natural grading of a deposit may be improved by crushing, by selective screening and

TABLE II

TEXTURAL CLASSIFICATION

	% Passing 4.75 mm (Approximate Range)
Gravel	0 - 20
Sandy Gravel	20 - 70
Gravelly Sand	70 - 95
Sand	95 - 100

	% Passing 75 μm (Approximate)
Silty	> 10
Slightly Silty	5 - 10

(Modified from Folk, 1968)

recombination, or by the combination of materials from different sources or areas. However, such processing increases production costs.

Grading limits are specified by users (e.g. D.O.T.), and will vary, depending upon the use to which the material will be put. As an example, Table III indicates the grading limits specified by the Department of Transportation for fine concrete aggregate. Poor grading may restrict the potential of some deposits for some uses. For example, an analysis of the fine fraction of those samples from the Blackville area which contained greater than 50 percent fine aggregate indicates that, after screening, only about 10 percent would meet the Department of Transportation requirements in the pit run state.

2) Lithologic Characteristics: The composition of the clasts within an aggregate deposit will have a significant effect on the quality of the material. Ideally, clasts should be hard, strong, and durable. Soft materials such as shale, schist, and friable sandstones are unsuited for use in most aggregate, since they disintegrate easily, while porous or fractured rock fragments may split due to the expansion of water as it freezes (Bates, 1969).

For high specification usage, the aggregate should be free of deleterious substances which can cause adverse chemical reactions. Amorphous or very fine-grained siliceous substances, such as chert and some felsic extrusives, are the primary offenders (Bates, 1969). In cases of suspected reactivity, the use of low-alkali portland cement or partial substitution of a pozzolanic material - such as fly-ash or finely ground siliceous

TABLE III

GRADING LIMITS FOR FINE CONCRETE AGGREGATE

Sieve Size	Total % passing (by weight)
9.5 mm	100
4.75 mm	95 - 100
2.36 mm	80 - 100
1.18 mm	50 - 85
600 µm	25 - 60
300 µm	10 - 30
150 µm	2 - 10
75 µm	< 3

(derived from D.O.T., 1980)

material - for some of the cement, is recommended (Bates, 1969; Lenhart, 1962). Coal and other organic fragments also constitute a significant deleterious substance. However, these materials may be removed with relative ease by means of floatation processing.

The lithologic analyses reported in the Appendix divide the clasts into two groups, sound and unsound. The two groups are differentiated primarily on the basis of the resistance of the clasts to disintegration under mechanical impact (with the exception of chert, which exhibits chemical instability in concrete). The results of this test should not be confused with those from quantitative soundness tests, such as the magnesium sulphate test, nor with abrasion tests, such as the Los Angeles abrasion loss test used by the Department of Transportation (the results of which are recorded in the Appendix, where available).

MAJOR AGGREGATE SOURCES

There are only three known major aggregate sources in the Blackville area. These are: 1) the Despres Lake esker; 2) the related ice-contact and outwash complex to the west, adjacent to the Southwest Miramichi River; and 3) the ice-contact deposits to the north in the Southwest Miramichi valley (the Blackville ice-contact deposit).

1) Despres Lake Esker: The Despres Lake esker extends as an almost continuous ridge over a distance of approximately 14 km. As indicated by Kingston (1974a, 1974b), its width is variable, ranging from approximately 30 to 350 m. Its maximum height above the surrounding terrain, in the order of 30 m, occurs at the fire

tower near its western end. The seismic work reported by Chandra et al. (1975), indicates that the thickness of the material frequently exceeds 10 m.

Reserves in this deposit are extremely large. Kingston (1974a, 1974b) estimated the total volume of the esker as in excess of 7.5 million m^3. However, the estimates obtained during this study indicate that reserves are more than double this amount. The eastern portion of the esker, to the east of Despres Lake, has estimated reserves of 420,000 m^3 (I12-15); the central portion, extending westward from Despres Lake to the north-south pulp road, has estimated reserves of 5 million m^3 (I12-14A); while the western portion has estimated reserves in excess of 12 million m^3 (I12-13).

Unfortunately, some of this material is subject to severe quality limitations. As indicated by the lithological analyses (I12-11 to 14B), the coarse material throughout consists predominantly of soft, friable sandstone. As a consequence, this portion of the material is suitable only for local use as fill. Observations suggest that approximately half of the material in the esker consists of such coarse material - Kingston (1974a, 1974b) suggests that one-half to one-third of the total material is recoverable. In contrast, however, the sand fraction of the deposit exhibits very good properties, and is being actively exploited for use in fine concrete aggregate from four major pits (three of which are on Crown Land). The only apparent significant quality limitation in this fine aggregate is the presence of isolated concentrations of coal particles, which must be removed

by processing.

Associated with the esker are minor outwash and kame deposits. Of these deposits, the kames to the west of Despres Lake, and south of the esker, have estimated reserves of 700,000 m^3 (see: I12-14A). Few exposures are available in these deposits; however, it seems likely that at least half of the material will consist of poor quality gravelly material. The outwash deposits have estimated reserves in the order of 1.5 million m^3 (see: I12-13, 14A), which appear to consist predominantly of fine sand (sometimes silty). In view of the shallow workable thickness of this material (about 1 m), and the abundance of material available from the esker, these deposits have no immediate significant resource potential.

2) Ice-Contact/Outwash Complex: This immense, complex deposit exhibits considerable relief, portions of the ice-contact deposits lying at least 16 m above the level of the flanking outwash. The estimated reserves are also immense, being in excess of 21 million m^3 (see: I12-8, 9, 10). Due to the paucity of exposures, it is difficult to fully appraise the aggregate potential of the material. However, the limited observations available allow a few general comments to be made.

The ice-contact deposits, which comprise approximately 80 percent of the total reserves, are extremely variable; materials ranging from fine sand through to cobbly and bouldery gravel have been observed. The quality of the material is also highly variable. The coarse aggregate associated with the southern esker system appears to be of very poor quality (see: I12-9),

consisting largely of soft sandstone, while that associated with the northern system appears to be of fair quality, comprising less than 50 percent soft sandstone (see: I12-8). While no estimate of the proportion of fine aggregate to coarse aggregate is possible, it seems likely that a considerable volume of the former will be present, some of which may have potential for high specification usage.

The outwash deposits, with total estimated reserves in excess of 4 million m^3 (I12-10), appear to consist almost totally of sand, which may have potential for use in fine concrete aggregate. However, due to the fact that this material is intimately associated with the ice-contact material, it is not known whether the full thickness of the material consists of sand (as it does at the one exposure, I12-10), or whether the sand overlies potentially poor quality gravel in some of the area.

In summary, it appears that this immense complex may have potential as a source of high specification fine aggregate, and possibly for intermediate specification coarse aggregate. However, detailed quality testing will be required before an accurate assessment of its aggregate potential can be made.

3) Blackville Ice-Contact Deposits: These deposits comprise the ice-contact deposit in the Southwest Miramichi valley to the south of Blackville, and the related deposit to the north, both on the east side of the river, and a possible related deposit on the west side of the river, to the south of Blackville. These deposits appear to relate to the same subglacial flow system which was responsible for the formation of the ice-contact/outwash deposit to the south.

These deposits are much smaller than the preceeding two. Reserves in the Blackville area are estimated to be in excess of 1 million m^3 (I12-5, 6); to the north of the Blackville area, these deposits, which extend to Renous, have even greater reserves (Lavergne and Hunter, 1982). As with the previously described ice-contact deposits, these are also extremely variable, with the observed material ranging from sand to cobbly gravel. However, the gravel in these deposits appears to be of better quality, and appears to improve in quality in a northerly direction. Unfortunately, a considerable proportion of the reserves outlined above lie within an area which has been subdivided (adjacent to and including locations I12-6 and 7); however, no development of this area has as yet occurred (as of November, 1982), and thus it may not yet be too late to exploit some of this material.

MINOR AGGREGATE SOURCES

In addition to the above major aggregate sources, several minor sources of aggregate suitable for local use are also present in the Blackville area. These sources are of two primary types: small deposits of fluvial origin, comprising, 1) ice-contact stratified drift deposits; 2) glaciofluvial outwash deposits; and 3) ancient alluvial deposits; and extensive sources (unmapped) which are of minor importance due to very shallow or erratic workable thicknesses, comprising, 4) sand veneer deposits and 5) modern alluvium, or to very poor material quality, comprising 6) till and weathered bedrock and 7) ablation till.

The general characteristics of these minor aggregate sources are outlined below.

1) Ice-Contact Stratified Drift: Most of the minor ice-contact stratified drift deposits relate to small esker systems. The Sabbies River esker system (see: I12-19, 20, 21) consists of a series of small segments, with estimated reserves ranging from limited (i.e. 50,000 m^3) to approximately 300,000 m^3 (along Chain Meadow Brook). The material in this system appears to coarsen eastwards, from predominantly sand at I12-19 through to cobbly gravel at I12-21. The coarse material, which dominates the available reserves, is of very poor quality.

To the west of the Cains River, an esker segment and associated "bead", related to the ice-contact/outwash complex to the northeast, is present. Estimated reserves are in the order of 400,000 m^3 (see: I12-9). Most of the observed material was sandy, and thus this deposit could contain some material suitable for high specification usage; any coarse aggregate present would be of very poor quality.

A small esker ridge extends across Highway 8 beside its junction with the road to Weaver Siding. This deposit, which has estimated reserves of 50,000 m^3 (I12-1), appears to contain a high proportion of fine aggregate - Hamilton and Carroll (1975) estimate 90% - and may constitute a good local source of such material. The coarse aggregate present is of very poor quality.

Another esker system appears to be present along the Bartholomew River, while a segment, possibly related to that at I12-1, is present to the west of The Lots. These deposits are not

currently accessible, and thus their composition is unknown. However, based on observations, and on the report of Lavergne and Hunter (1982) on a related deposit to the west, north of Doaktown, it appears that the quality of the material will probably be poor. Reserves were not estimated, but will probably vary from limited to a few 100,000 m^3 for each individual esker segment.

In addition to the above deposits, an ice-contact deposit of unknown origin and indeterminable extent is present on the south side of the Southwest Miramichi River, across from Molasses Hill. This material appears to be of poor quality, the roadcut exposing silt, sand, and sandy gravel with cobbles. Also, a small, isolated kame is present between the Cains River and the West Branch Sabbies River (I12-18). Reserves are minimal, and of very poor quality. This deposit is not obvious on the aerial photographs, and similar deposits (and also small esker segments) could be scattered throughout the area, but obscured from view by vegetation.

2) Glaciofluvial Outwash: Most of the outwash deposits in the Blackville area are associated with the major ice-contact deposits. The only apparent exceptions are a small deposit occupying a portion of the preglacial Southwest Miramichi channel, to the west of Molasses Hill (I12-2), and a poorly defined deposit along the Middle Branch Barnaby River (I12-16, 17). Exposures in the former deposit are poor; however, its shape suggests that it may, in part, be of deltaic origin. If so, its reserves could be significantly greater than the estimated 50,000 m^3, and could contain a significant sand component.

The outwash along the Middle Branch Barnaby River is largely inundated, with only local areas rising above the level of the bogs. Consequently, the workable reserves are limited. This is unfortunate, because some of this material is among the best quality coarse aggregate in the map-area; some of the material has been recommended for base course use by the Department of Transportation (1967). It would probably not constitute a good concrete aggregate, however, due to the high chert content (5%). The most likely explanation for the occurrence of such anomalously high quality material in this area is that the material was derived from mature, preglacial gravels within the preglacial valleys, which were subsequently reworked during glaciation.

3) Ancient Alluvium: Ancient alluvial deposits are irregularly distributed along the Southwest Miramichi River valley, along the upper portion of the Cains River valley, and along a portion of the Bartholomew River valley. Observations and Department of Transportation (1962) information indicates that along the Southwest Miramichi valley the material varies from sand to poor quality sandy gravel, though the former appears to be predominant. The material along the Bartholomew River appears to be similar, while that along the Cains River appears to be generally finer, with some silt and clay.

In places, these deposits may overlie older materials. At several localities, these materials have been observed overlying deep-water (marine?) clays, whereas at Upper Blackville it appears that they may bury an ice-contact deposit.

The aggregate potential of these various deposits is

limited, due primarily to either difficulty of access, or, more commonly, to the fact that they are traversed by roads and sterilized by the accompanying residential development.

4) Sand Veneer Deposits: Thin, locally extensive deposits of sand, and minor gravel, are found at a number of localities within the map-area. With the exception of some areas flanking the Despres Lake esker, these deposits appear to lie below the 200 ft (61 m) contour level. In the former case it would appear that they comprise thin outwash blankets; in the latter case a marine origin seems more likely. These deposits are patchy, and are generally less than 1 m in thickness. However, in some localities pockets of thicker material may be present, such as near Arbeau Settlement, where thicknesses in excess of 2 m were observed.

Minor shoreline features may be associated with these deposits. Only one such feature has been observed, to the west of Howard along Morse Brook (I12-4), though others are no doubt present, but obscured by vegetation. The material at this site is coarse in texture, and consequently of poor quality.

5) Modern Alluvium: Modern alluvium comprises that material present within the floodplains of the streams. Significant areas of such material are present along the Southwest Miramichi, Bartholomew, and Cains Rivers. Observations indicate that much of this material consists of sand, commonly silty. However, some gravel is present in such deposits in the Bartholomew valley, though the quality of the material is poor (I12-3).

The aggregate potential of this material in the Blackville

area is generally limited, due to such factors as the generally poor quality to the material, the shallow depths to the water table, and to environmental considerations.

6) Till and Weathered Bedrock: As can be seen from the widespread distribution of quarrys on the accompanying map, the weathered sandstone of the area has seen extensive use as a source of borrow material. While the quality of this type of material is poor (as indicated by D.O.T. testing), when incorporated with the overlying till it appears to constitute a reasonable aggregate for use in logging road construction. In general, the sandstone is sufficiently weathered to allow the upper 1 to 1.5 m to be excavated using conventional excavation equipment.

Because this material is almost ubiquitously present throughout the area, reserves are essentially unlimited.

7) Ablation Till: Ablation till comprises that material which, having been carried into the terminal zone of a melting glacier by transport within or upon the ice, is deposited onto the ground surface by sliding, flowing, or subsidence (Flint, 1971). Consequently, "the resulting till is therefore loose, noncompact, and nonfissile, and its clasts are less strongly abraded than those in lodgement till" (Flint, 1971, p. 171).

Ablation till occurs primarily in the area lying between that part of the Despres Lake esker to the south of South Lake, and the southern half of the northwesterly trending reach of the Cains River. However, small patches of this material also occur at a few other locations, primarily in the southern part of the

map-area. In general, the ablation till consists of angular, cobbly to bouldery sand and gravel. It forms areas of hummocky to ridged topography, with thicknesses varying from almost nil to about 10 m.

The component clasts in the ablation till consist mainly of soft, local sandstone. Since ablation tills typically comprise a very poorly sorted admixture of clay, silt, sand, gravel, cobbles, and boulders, the textural and physical characteristics of this material are essentially akin to those of the weathered bedrock.

CONCLUSIONS

Workable reserves of regionally significant granular aggregate material in the Blackville map-area are estimated to be in excess of 43 million m^3. Almost all of this material is found associated with a large ice-contact system which extends southward down the Southwest Miramichi valley to the mouth of the Cains River, and from thence eastward to the east of Despres Lake. For the purpose of this study, the above quantity refers to the material that appears to be physically extractable. However, it does not entirely take into account the sterilizing effects of various cultural, economic, or physical restrictions, which may limit or even restrict access to these reserves.

In general, the coarse aggregate within the area is of very poor to poor quality, consisting predominantly of soft sandstone clasts. However, in the northern part of the area, some material of fair to possibly good quality is present. A significant proportion of the reserves, possibly up to 50 percent, consists of fine aggregate. In contrast to the coarse aggregate, this material appears, in general, to be of good to excellent quality. Such material in the Despres Lake esker is being actively exploited for use in fine concrete aggregate.

In addition to the above reserves, extensive quantities of borrow material are available from the weathered sandstone which is almost ubiquitous throughout the area, and to a much lesser extent from a variety of minor surficial deposits. Minor amounts of better quality material may also be available from some of the latter sources.

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APPENDIX

SAMPLE DESCRIPTIONS

OF

BLACKVILLE MAP-AREA

21 I/12

LOCATION #: I12-1 NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Pit Parish: Blissfield

Status: Active on demand (lightly) UTM: 729 645

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Silty, gravelly sand; oxidized.

1.2 m Sand, and Gravelly Sand: Horizontally stratified well-sorted medium sand and gravelly medium to very coarse sand; a silty fine sand layer up to 0.3 m thick is locally present at the top of the unit (it is not included in the sample).

0.3 m Slump Covered: Assumed to be material as above

This small deposit, comprising a low northeast-southwest trending ridge, has very indistinct boundaries. Where it is cut by Hwy 8, it appears to lie, in part, within a shallow bedrock channel. The material in this deposit is quite variable, ranging from material as described above through to dirty, cobbly sandy gravel. A number of large boulders, about 1 m in size, are locally present within the deposit. The component clasts within the deposit consist almost totally of sandstone, and thus

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MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing		96.8	95.7	92.8	89.6	80.5	63.6	42.1	11.9	3.5	1.9
(partial)					100.0	89.9	71.0	47.0	13.3	3.9	2.1

LITHOLOGIC ANALYSIS: N.A.

Unsound Lithotypes	%	Sound Lithotypes	%

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
12	5	1	50,000

LOCATION #: I12-1 (cont'd)

the quality of the coarse aggregate is very poor.

Similar material is probably present in the currently inaccessible esker segments along the Bartholmew River, and to the west of The Lots.

LOCATION #: I12-2 NTS: 21 I/12

Type of Deposit: Glaciogluvial outwash County: Northumberland

Exposure Type: Roadcut Parish: Blissfield

Status: Undeveloped UTM: 745 627

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material; slightly silty.

0.9 m Sand: Faintly stratified, well-sorted fine to medium sand; Sample A was obtained from this unit.

0.5 m Sandy Gravel: Poorly sorted fine to coarse sand and predominantly medium to coarse gravel, with a few cobbles; clasts are subangular to subrounded, and generally platy, with nil to light silt coatings; maximum observed clast size = 0.3 m; no stratification is evident; Sample B was obtained from this unit.

This deposit lies in the western end of what appears to be an abandoned segment of the preglacial Southwest Miramichi River valley. Buried preglacial sand and gravel deposits could be present in the abandoned valley; however, exploitation of such deposits, if present, would probably not be economically feasible.

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MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A						-	98.6	87.0	36.2	9.3	3.5
B		86.1	81.7	69.2	62.2	56.6	52.0	41.7	16.6	4.7	2.3
(partial B)					100.0	91.0	83.6	67.0	26.7	7.6	3.7

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 84%

soft sandstone 81; soft metasedimentary 1; schist 1; weathered 1

Sound Lithotypes 16 %

greywacke 5; hard sandstone 4; quartzite 3; felsic extrusive 1; mafic intrusive 1; mafic extrusive 1; gneiss 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
20	5	1	50,000

LOCATION #: I12-2 (cont'd)

The surficial deposit also has limited potential. While the deposit area is fairly large, the presence of a stream bisecting the deposit renders most of the area unworkable. In addition, the quality of the material is poor, the component clasts consisting predominantly of soft sandstone.

LOCATION #: I12-3 (cont'd)

extraction of material adjacent to a stream can create environmental problems. Consequently, these deposits have not been mapped.

LOCATION #: I12-3 NTS: 21 I/12

Type of Deposit: Alluvium County: Northumberland

Exposure Type: Hand-dug test pit Parish: Blackville

Status: Abandoned UTM: 806 776

SECTION DESCRIPTION & COMMENTS:

0.3 m Overburden: Soil developed on a silty fine sand.

0.2 m Sand: Clean, well sorted, fine sand.

0.7 m Sandy Gravel: Faintly stratified medium to coarse sand and very fine to medium gravel; clasts are subangular to rounded, with nil to very light silt coatings; maximum observed clast size = 7 cm; the sample was obtained form this horizon.

D.O.T. (1962) testing in this area indicates that the material in this deposit is highly variable, ranging from silty sand through to sandy gravel. The coarse material is of poor quality, having an average Los Angeles abrasion loss of 58.9%. It is recommended for borrow usage.

The reserves in this deposit, and in similar deposits elsewhere in the map-area, are limited due to the shallow depth to the water table (the three small pits in the deposit are all flooded). In addition,

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MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing		96.4	90.9	66.4	51.9	39.4	30.4	20.0	4.9	0.8	0.4
(partial)					100.0	75.9	58.6	38.5	9.4	1.5	0.8

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 79%

soft sandstone 76; friable granite 1; soft mafix extrusive 1; weathered 1

Sound Lithotypes 21%

hard sandstone 5; quartzite 5; quartz 3; felsic intrusive 2; felsic extrusive 2; greywacke 2; hard metasedimentary 1; gneiss 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Limited

LOCATION #: I12-4 NTS: 21 I/12

Type of Deposit: Shoreline (?) County: Northumberland

Exposure Type: Pit Parish: Blackville

Status: Abandoned UTM: 845 722

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: . Soil development on the underlying material; silty.

0.6 m Sandy Gravel: Medium to coarse sand and predominantly very fine to medium gravel; clasts are subangular to subrounded, with light to moderate silty coatings; maximum observed clast size = 0.2 m; no stratification is visible.

Approximately 0.5 m of sand and gravel lies below the above section, below which till is present.

This deposit appears to relate to submergence of the area subsequent to deglaciation. Other similar deposits are present, primarily adjacent to the Miramichi River, below an elevation of 200 ft. (61 m). In most cases the material is finer than that described above, consisting predominantly of sand. Reserves in such deposits are generally minimal, and consequently the deposits were not mapped. They may, however, provide a local source of material.

MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing		95.0	88.2	72.0	55.9	39.9	29.7	17.9	8.0	4.1	3.0
(partial)					100.0	71.4	53.1	32.0	14.3	7.3	5.4

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 88 %

soft sandstone 87; weathered 1

Sound Lithotypes 12 %

quartzite 4; hard sandstone 3; gneiss 2; felsic extrusive 1; greywacke 1; quartz 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Minimal

LOCATION #: I12-5 NTS: 21 I/12

Type of Deposit: Ice-contact County: Northumberland

Exposure Type: Pit Parish: Blackville

Status: Active on demand UTM: 851 808

SECTION DESCRIPTION & COMMENTS:

WEST FACE

0.5 m Overburden: Oxidized, slightly silty fine sand, with a few pebbles.

0.3 m Sandy Gravel: Poorly sorted sand and gravel; gravel is fine to coarse; sand grades downwards from silty very fine sand to clean fine to medium sand.

0.6 m Gravelly Sand: Subhorizontally stratified fine to medium (minor coarse) sand, with frequent small pebbles (~5%).

0.3 m Sand: Clean, well-sorted, cross-laminated fine sand.

0.7 m Sandy Gravel: Horizontally stratified, predominantly very fine to medium gravel; some openwork layers are present; the matrix, where present, generally consists of fine sand; a few lenses of gritty fine sand, and some cobbles, are also present.

0.2 m Sand: Horizontally stratified, medium to very coarse sand.

0.2 m Sandy Gravel: Medium to very coarse sand and very fine to coarse gravel.

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MECHANICAL ANALYSIS:

sieve	100 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A		94.4	91.1	78.6	66.3	56.7	47.7	36.3	25.2	9.1	3.4
(partial A)					100.0	85.5	71.9	54.8	38.0	13.7	5.1
B	71.4	34.1	31.7	28.1	25.3	20.0	11.3	3.6	1.9	1.3	1.0

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 28%

soft sandstone 22; weathered 2; shale 1; slate 1; pyritiferous sandstone 1; chert 1

Sound Lithotypes 72%

greywacke 20; hard sandstone 12; gneiss 8; hard metasedimentary 7; quartzite 6; felsic intrusive 5; hornfels 5; quartz 4; mafic extrusive 1; feldspar 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
8 (within map-area	2	3	60,000

LOCATION #: I12-5 (cont'd)

0.6 m Sand: Generally clean fine sand, but with up to 10 cm of silt at the top of the unit.

0.6 m Slump Covered: Assumed to be sand and/or gravel.

Sample A is a composite sample from all of the units in the above section, excluding the upper 0.8 m.

SOUTH FACE

0.5 m Overburden: Estimated (partially removed); appears to have been as above.

1.8 m Sandy Gravel: Horizontally stratified, cobbly coarse to very coarse gravel; contains a few thin (~10 cm) openwork layers, but generally has a matrix of predominantly coarse to very coarse sand; a few boulders are present, but are generally small; average clast size is in the order of 3 to 5 cm; Sample B was obtained from this unit.

1.1 m Slump Covered: As above, or possibly finer (sand is present below similar material in the east face of the pit).

The clasts in this deposit are generally subrounded to well-rounded, and exhibit nil to light silt coatings. Maximum observed clast size was approximately 1 m.

Based on the lithologic analysis, the material in this deposit appears to be the best in the Blackville area. Reserves are not great within the map-area; however, the total deposit reserves are quite large -Lavergne & Hunter (1982, I13-77) estimate the reserves in the Newcastle portion of the deposit at 600,000 m^3.

LOCATION #: I12-6 NTS: 21 I/12

Type of Deposit: Ice-contact County: Northumberland

Exposure Type: Roadcut Parish: Blackville

Status: Undeveloped UTM: 851 768

SECTION DESCRIPTION & COMMENTS:

0.5 m Overburden: Soil development on the underlying material.

1.6 m Gravel: Poorly sorted, cobbly coarse to very coarse gravel, with a few boulders; clasts are subrounded to well-rounded, with moderate to heavy silt coatings; the matrix consists of generally silty coarse to very coarse sand and very fine to fine gravel; no stratification is evident.

3.1 m Slump Covered: Assumed to be material as above.

This deposit appears to be related to the one to the north (I12-5). The higher local sandstone content in this deposit suggests that flow in the system was southward.

The above section appears to be representative of the core of this ice-contact deposit. Most exposures in this deposit expose generally finer material (i.e. see I12-7).

.... over

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	79.6	47.8	39.0	28.3	22.5	17.8	13.9	9.4	7.3	6.5	5.8

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 47%	Sound Lithotypes 53 %
soft sandstone 42; friable granite 3; weathered 2	greywacke 22; quartzite 8; hard sandstone 7; hard metasedimentary 3; gneiss 3; hornfels 3; felsic intrusive 2; mafic intrusive 2; quartz 2; felsic extrusive 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
70	15	5	750,000
	40	1	400,000

LOCATION #: I12-6 (cont'd)

This deposit extends for a considerable distance down the Southwest Miramichi valley. However, only in the central portion of this area, from the site of the above section to a point approximately 100 m southeast of I12-7, is the deposit of considerable thickness. Unfortunately, this area has been subdivided (though as yet undeveloped), which may restrict access to the material.

A related deposit appears to be present on the west side of the river. The extent of this deposit is not fully known, and neither is the thickness; consequently, reserves for this area were not calculated. The roadcut exposure consisted of sand.

LOCATION #: I12-7 NTS: 21 I/12

Type of Deposit: Ice-contact County: Northumberland

Exposure Type: Roadcut Parish: Blackville

Status: Undeveloped UTM: 855 766

SECTION DESCRIPTION & COMMENTS:

EAST SIDE OF ROAD

0.4 m Overburden: Soil development on the underlying material; slightly silty.

0.4 m Sand: Massive, predominantly medium to coarse sand, with a few pebbles.

0.5 m Gravelly Sand: Faintly stratified, predominantly medium to coarse sand with minor, predominantly very fine, gravel.

0.8 m Sand: Horizontally stratified medium to very coarse sand, with a few pebbles.

0.5 m Slump Covered: Assumed to be material as above.

Sample A was obtained from this section.

.... over

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A		95.7	95.7	95.1	93.2	88.7	75.1	42.6	12.2	3.8	2.0
(partial A)					100.0	95.2	80.6	45.7	13.1	4.1	2.1
B	97.8	85.8	81.2	66.4	55.1	40.7	19.5	6.6	3.5	2.6	1.9
(partial B)					100.0	73.9	35.4	12.0	6.4	4.7	3.4

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 45 %

soft sandstone 44; chert 1

Sound Lithotypes 55 %

quartzite 19; greywacke 14; gneiss 7; felsic intrusive 3; hard metasedimentary 3; mafic extrusive 2; hard sandstone 2; hornfels 2; mafic intrusive 1; hard siltstone 1; quartz 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			See I12-6

LOCATION #: I12-7 (cont'd)

WEST SIDE OF ROAD

(~25 m west of A)

0.4 m Overburden: As above

1.2 m Sandy Gravel: Crudely stratified coarse to very coarse sand and very fine to coarse gravel, with a few cobbles; clasts are sub-rounded to well rounded, with nil to light silt coatings.

0.9 m Slump Covered: Assumed to be material as above.

Sample B was obtained from this section.

The materials described above appear to be more representative of the bulk of the material in this ice-contact deposit than does the coarse material at I12-6. The maximum relief in this vicinity between the ice-contact deposit and the blanking ancient alluvium is 16 m. However, this area also lies within a subdivided, but as yet undeveloped, area, which may restrict access to the material.

LOCATION #: I12-8 NTS: 21 I/12

Type of Deposit: Ice-contact County: Northumberland

Exposure Type: Roadcut Parish: Blackville

Status: Undeveloped UTM: 888 730

SECTION DESCRIPTION & COMMENTS:

SITE A

0.4 m Overburden: Soil development on the underlying material; slightly silty.

1.3 m Sand: 0.7 m fine sand over 0.6 m predominantly medium sand; well sorted; a few pebbles are present; no stratification is evident; the sample was obtained from the lower portion of the unit.

SITE B

(~30 m north of A)

0.4 m Overburden: As above.

1.4 m Gravelly Sand and Sandy Gravel: Medium to very coarse sand with variable amounts of very fine to coarse gravel; the centre of the unit is the most gravelly; a few cobbles are present; clasts are subrounded to well rounded, with nil to light silt coatings; maximum observed clast size = 0.3 m.

.... over

MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A					-	99.6	99.2	88.0	24.4	3.8	1.9
B		88.8	85.2	76.1	64.6	45.6	27.5	15.8	4.3	1.9	1.5
(partial B)					100.0	70.6	42.6	24.5	6.7	2.9	2.3

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 44 %

soft sandstone 39; weathered 2; soft siltstone 1; slate 1; chert 1

Sound Lithotypes 56 %

quartzite 12; greywacke 11; hard sandstone 8; gneiss 7; hard metasedimentary 6; felsic intrusive 5; quartz 3; mafic extrusive 2; hornfels 2

ESTIMATION OF RESERVES:

	total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
A	200	80	10	8 million
		70	5	3.5 million
B	17	15	5	750,000

LOCATION #: I12-8 (cont'd)

Observations in this large deposit indicate that the material is highly variable, from very coarse cobbly, bouldery gravel to fine sand. Consequently, it has the potential for producing a large variety of materials. The quality of the coarse material is relatively good with respect to that available elsewhere in the Blackville area. D.O.T. (1978) testing of the small pit at the northern end of the deposit (UTM 884 745) indicates a Los Angeles abrasion loss of 31.5%. Detailed testing is recommended to fully evaluate the aggregate potential of this deposit.

Reserve estimates are presented for three areas: A) the main body of the deposit lying between the Southwest Miramichi River and the powerline, B) the two detached segments adjacent to the powerline and Black Brook, and C) the ridge to the south of the main deposit, within the area of outwash.

LOCATION #:	I12-9	NTS:	21 I/12
Type of Deposit:	Esker	County:	Northumberland
Exposure Type:	Pit	Parish:	Blackville
Status:	Active on demand (lightly)	UTM:	894 702

SECTION DESCRIPTION & COMMENTS:

WESTERN SECTION

0.4 m Overburden: Soil development on the underlying material; slightly silty.

1.1 m Sandy Gravel: Poorly sorted medium to very coarse sand and very fine to coarse gravel; becomes cobbly towards the base; appears massive.

0.6 m Sand and Silty Sand: 0.2 m fine sand to fine sandy silt, with minor clay seams / 0.2 m fine to medium sand, with a few small pebbles / 0.2 m fine sand to silty very fine sand, with minor clay seams.

1.2 m Sandy Gravel: Poorly sorted medium to coarse sand and medium to very coarse gravel, with a few cobbles and small boulders; includes minor lenses (up to 20 cm thick) of fine to medium sand, and of coarse sand with minor fine gravel; clasts are subrounded to rounded, with light to moderate silt coatings; the sample was obtained from this unit, exclusive of the cobble and boulder fraction, which was visually estimated at <5%.

.... over

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	86.0	66.7	61.0	50.9	43.3	35.4	27.0	16.5	8.2	4.7	3.5

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 90 %	Sound Lithotypes 10%
soft sandstone 88; chert 1; weathered 1	hard sandstone 3; gneiss 2; quartzite 2; greywacke 1; argillite 1; hard meta sedimentary 1

ESTIMATION OF RESERVES:

	total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
A	60	38	10	3.8 million
		16	2	320,000
B	10	8	2	160,000
C	10	3	10	300,000
		5	2	100,000

LOCATION #: I12-10 (cont'd)

large area lying between Black Brook and the main ice-contact deposit, B) the area to the northeast of the main ice-contact deposit, and C) the area to the south of Black Brook. In addition to these areas, an extensive area of sand is present bounded by the Cains River, Area A (above), and the main ice-contact deposit south of Black Brook. However, the material in this area is generally thin, and locally wet at the surface.

LOCATION #: I12-9 (cont'd)

0.5 m Sand and Silty Sand: Interbedded fine sand and silty very fine sand.

0.5 m Slump Covered: Assumed to be sandy gravel, since such material lies at the base of the above sand unit.

The upper sand and silty sand unit appears to be part of a trough fill unit, which wedges out to the east, where the upper and lower sandy gravel units merge into one. Further to the east the material becomes even coarser.

EASTERN SECTION

(~10 m east of Western Section)

1+ m Cobbly, Bouldery, Sandy Gravel: Gravel is generally coarse to very coarse; matrix consists of generally fine to coarse sand; most of the clasts consist of sandstone, some of which have broken along the bedding planes; maximum clast size is 0.8 m, but most clasts are smaller than 0.4 m in size.

This esker feeds into a large ice-contact fan. There are no exposures in this latter deposit. However, it probably exhibits a textural variability akin to that exhibited by similar deposits to the north (i.e. I12-6, 7, 8). Since the feeder esker contains poor quality gravel, this esker fan will probably be similar. Similar comments pertain to the esker segment to the south of Black Brook, further to the northeast.

To the west of the Cains River, a western extension of the esker, and a small esker fan are present. Limited exposures suggest that the material varies from fine sand through to sandy gravel.

Estimated reserves are calculated for three areas: A) the large esker fan and the associated feeder esker, B) the esker segment to the northeast, south of Black Brook, and C) the esker and esker fan to the west of the Cains River.

LOCATION #: I12-10 NTS: 21 I/12

Type of Deposit: Outwash County: Northumberland

Exposure Type: Dump trench Parish: Blackville

Status: Undeveloped UTM: 900 720

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development of the underlying material; slightly silty.

1.1 m Sand: Horizontally stratified fine to medium sand.

0.4 m Sand: Cross-bedded fine to medium sand; palaeoflow direction was towards the east.

0.8 m Sand: Sand texturally similar to that above (probe hole below the base of the section).

Most of the outwash in the ice-contact outwash complex is probably similar to that described above. However, in some areas, coarser ice-contact material may be present near, or at, the surface. Consequently, test-pitting would be required to define areas of suitable thickness, and quality, for extraction.

The estimated reserves are calculated for three areas: A) the

.... over

MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing						-	99.4	91.7	48.9	10.8	2.8

LITHOLOGIC ANALYSIS: N.A.

Unsound Lithotypes	%	Sound Lithotypes	%

ESTIMATION OF RESERVES:

	total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
A	180	150	2	3 million
B	120	100 (?)	1	1 million
C	90	40+(?)	1	400,000

LOCATION #:	I12-11	**NTS:**	21 I/12
Type of Deposit:	Esker	**County:**	Northumberland
Exposure Type:	Hand-dug test pit	**Parish:**	Blackville
Status:	Undeveloped	**UTM:**	936 713

SECTION DESCRIPTION & COMMENTS:

0.3 m Overburden: Soil development on the underlying material; slightly silty.

0.2 m Sandy Gravel: Moderately sorted medium to very coarse sand and predominantly very fine to fine gravel.

0.6 m Gravelly Sand: Material as above, but with less gravel.

Clasts are subrounded to well rounded, with light silt coatings. Maximum observed clast size was 4 cm.

The height of the esker at this site is approximately 5 m.

MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing		90.8	88.2	80.4	69.5	50.5	29.5	13.3	3.5	2.0	1.5
(partial)					100.0	72.7	42.6	19.1	5.0	2.9	2.2

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 79%	Sound Lithotypes 21%
soft sandstone 75; friable granite 2; chert 2	quartzite 8; greywacke 4; quartz 3; hard sandstone 2; felsic intrusive 1; mafic extrusive 1; hard metasedimentary 1; gneiss 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			See I12-13

LOCATION #: I12-12 NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Pit Parish: Blackville

Status: Inactive UTM: 959 710

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material; slightly silty.

1.6 m Gravel: Massive, coarse, bouldery cobble gravel, with a matrix of medium to very coarse sand and very fine to fine gravel; clasts are subrounded to well rounded, with light to moderate silt coatings; maximum observed clast size = 0.4 m; the sieve sample is exclusive of the cobble and boulder fraction, which was visually estimated as 40 to 50% of the unit.

1.7 m Slump Covered: Assumed to be material as above.

The vast majority of the cobbles and boulders present consist of the soft local sandstone. Consequently, the aggregate potential of this material is poor.

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	71.8	59.6	55.7	47.7	38.9	27.7	17.4	9.6	3.4	1.8	1.3

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 75 %

soft sandstone 69; weathered 3; friable granite 1; chert 1; soft metasedimentary 1

Sound Lithotypes 25 %

greywacke 9; quartzite 7; mafic extrusive 2; gneiss 2; quartz 2; felsic intrusive 1; felsic extrusive 1; hornfels 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			See I12-13

LOCATION #: I12-13 NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Pit Parish: Blackville

Status: Active on demand UTM: 986 701

SECTION DESCRIPTION & COMMENTS:

NORTH FACE

(Composite of ~10 m Longitudinal Section at the Crest)

0.4 m Overburden: Soil development on the underlying material; slightly silty.

0.9 m Sandy Gravel: Crudely stratified medium to coarse sand and predominantly fine to medium gravel; a few cobbles and boulders are present.

1.5 m Gravelly Sand: Horizontally stratified, predominantly medium sand, with predominantly fine gravel.

0.3 m Sandy Gravel: Poorly sorted medium to very coarse sand and fine to coarse gravel.

1.1 m Sand: Cross-bedded fine sand grading downwards into medium sand; well sorted.

11.3 m Slump Covered: Probably sand.

.... over

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A	97.9	95.0	92.5	80.6	68.4	56.8	43.0	20.3	3.3	1.6	1.2
B					-	99.8	97.3	80.6	31.5	4.2	1.3
C						-	99.5	89.5	23.7	3.0	0.8

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 63 %

soft sandstone 58; weathered 3; chert 2

Sound Lithotypes 37 %

greywacke 12; quartzite 6; gneiss 4; felsic imtrusive 3; hard sandstone 3; quartz 3; mafic extrusive 2; hornfels 2; hard siltstone 1; argillite 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
ice-contact 235	50	10+	5 million
	150	5	7.5 million
outwash 115	100	1	1 million

LOCATION #: I12-13 (cont'd)

Sample A was obtained from the three gravelly units. Clasts in these units are subrounded to well rounded, with nil to light silt coatings. Maximum observed clast size was 0.6 m.

Sample B was obtained from the sand unit.

WEST FACE

(~180 m West of Above Sections; Representative of Deposit Flank)

0.4 m Overburden: Estimated; removed.

4.5 m Sand: Trough cross-stratified predominantly medium sand with minor fine sand; minor silt lenses, and thin bands of coal particles (up to 1 cm in size), are also present; minor postdepositional faulting is also present; Sample C was obtained from this unit.

1.2 m Slump Covered: Assumed to be material as above.

Material was being removed from this face, and also from the pit to the west (UTM 981 704), for use in fine concrete aggregate.

Reserves are estimated for the section of the esker extending from the vicinity of I12-11 to the west through to the north-south logging road to the east. These estimates include both the good quality fine material, as described above, and the poor quality coarse material, as present at I12-12.

Reserves are also presented for the outwash deposits, consisting predominantly of sand, which flank this portion of the esker. However, the aggregate potential of these deposits is limited by the generally thin workable thickness.

All of these materials lie on Crown land.

LOCATION #: I12-14A NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Pit complex Parish: Rogersville

Status: Active on demand UTM: 027 695

SECTION DESCRIPTION & COMMENTS:

FLANK SECTION

0.5 m Overburden: Soil development on the underlying material; slightly silty.

3.3 m Sand: Large- to small-scale trough cross-stratified, predominantly medium to coarse sand; Sample A from the small-scale cross strata, and Sample B from the large-scale, indicate that the former is slightly finer and better sorted than the latter.

This section was being operated to supply material for use in fine concrete aggregate.

INTERIOR SECTION

0.5 m Overburden: As above.

2.0 m Sandy Gravel: Cross-stratified medium to coarse sand and very

.... over

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A					-	99.2	88.1	33.4	4.1	1.3	0.8
B					-	93.8	73.4	29.9	5.8	1.1	0.5
C	96.2	93.2	90.1	80.4	70.0	61.6	53.4	31.9	5.4	1.7	1.0
(partial C)					100.0	88.0	76.3	45.6	7.7	2.4	1.4

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 89%

soft sandstone 87; soft siltstone 1; weathered 1

Sound Lithotypes 11 %

hard sandstone 3; quartz 3; quartzite 2; felsic intrusive 2; felsic extrusive 1

ESTIMATION OF RESERVES:

	total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
A	110	10	10+	1 million
		80	5	4 million
B	42	35	2	700,000
C	75	50	1	500,000

LOCATION #: I12-14A (cont'd)

fine to medium gravel; clasts are subrounded to well-rounded, with nil to light silt coatings; Sample C was obtained from this unit.

3.5 m Slump Covered: Assumed to be predominantly sand.

This latter section lies between the flank section and the centre of the ridge. The material becomes coarser towards the centre of the ridge, grading from the sand at the flanks to cobbly sandy gravel at the core. The maximum observed clast size in the coarse material was 0.6 m.

To the south of the esker in this area, areas of kame deposits and outwash are present. These materials are variable in texture, from fine sand through to sandy gravel. Consequently, the quality of these materials will also be variable.

Reserves are estimated in three parts: A) estimated reserves in the esker deposits lying between the north-south logging road to the west and Despres Lake to the east, B) estimated reserves in the kame deposits to the south of the esker, and C) estimated reserves in the outwash deposits to the south of this portion of the esker. The significance of the aggregate potential of the latter deposits is limited due to the generally thin workable thickness. Almost all of these reserves lie on Crown land.

LOCATION #: I12-14B NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Pit complex Parish: Rogersville

Status: Inactive UTM: 029 696

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Estimated (partially removed).

0.9 m Sandy Gravel: Poorly sorted, curdely stratified medium to very coarse sand and predominantly fine to medium gravel.

0.8 m Gravelly Sand: Cross-stratified, medium to coarse sand, with minor pebbles and some gravelly layers.

0.7 m Sand: Faintly stratified, medium to coarse sand, with minor pebbles in the lower 0.2 m.

1.3 m Sandy to Silty Gravel: Cobbly, generally very coarse gravel, with a matrix grading downwards from poorly sorted fine to coarse sand through silty sand to silt; unit appears massive.

1.5 m Slump Covered: Assumed to be material as above.

Sample A was obtained from the upper three units (below the overburden); Sample B from the lowest unit. Clasts were generally subrounded

.... over

MECHANICAL ANALYSIS:

sieve	100 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A		89.9	86.3	74.9	64.6	56.8	47.5	22.9	5.1	2.8	2.0
(partial A)					100.0	87.9	73.5	35.4	7.9	4.3	3.1
B	89.6	31.5	30.1	27.7	25.7	23.6	21.4	19.4	15.9	9.3	7.2

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 97 %

soft sandstone 92; weathered 4; schist 1

Sound Lithotypes 3 %

mafic extrusive 1; hard sandstone 1; quartzite 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			See I12-14A

LOCATION #: I12-14B (cont'd)

to rounded, with light to heavy silt coatings. The maximum observed clast size was 0.4 m.

The above section was at the crest of the ridge. The upper units thin towards the flanks; locally, coarse material is present to the surface. The height of the esker crest at this point is approximately 15 m.

A comparison between this pit and the one approximately 200 m to the west (I12-14A) illustrates the marked lateral variability which can occur in this ice-contact deposit.

LOCATION #: I12-15 NTS: 21 I/12

Type of Deposit: Esker County: Kent

Exposure Type: Pit Parish: Huskisson

Status: Active on demand UTM: 056 687

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material; slightly silty.

5.6 m Sand: Trough cross-stratified sand; individual trough sets vary from fine sand to very coarse sand with minor very fine gravel; however, medium sand is dominant; palaeoflow direction was towards the east.

1.0 m Slump Covered: Assumed to be material as above.

The above section is at the western end of a large pit area. Most of the exposed material consists of sand, though local gravelly units are present. However, near the centre of the pit area, a core of very coarse, bouldery material is present. Since the clasts in this coarse material consist predominantly of soft local sandstone, the quality of this material is very poor. The sand, however, is of very good quality, and is used for fine concrete aggregate.

MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing				-	99.3	95.1	84.9	59.6	11.0	1.1	0.7

LITHOLOGIC ANALYSIS: N.A.

Unsound Lithotypes	%	Sound Lithotypes	%

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
28	4	5	200,000
	11	2	220,000

LOCATION #: I12-16A NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Pit Parish: Rogersville

Status: Active on demand (by hand) UTM: 063 783

SECTION DESCRIPTION & COMMENTS:

0.2 m Soil: Loose soil developed on the underlying material.

1.1 m Sandy Gravel: Horizontally stratified, poorly sorted medium to coarse sand and medium to very coarse gravel, with a few cobbles; clasts are subangular to subrounded, with light to moderate silt coatings; this unit is heavily iron-cemented, particularly in the upper half; Sample A was obtained from this unit (the lower half of the unit is locally sandier than at the sampled section).

0.5 m Sand: Faintly stratified fine sand, with minor medium sand layers; a few pebbles are present near the base.

0.2 m Gravelly Sand: Apparently massive, predominantly medium sand with minor very fine to fine gravel.

- Till: Very dense, reddish-brown, clayey sand till.

Sample B was obtained from the two sand units. A large granitic boulder (1+ m in size) is exposed in the pit face 3 m to the south of the above section. .... over

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing A	82.9	67.2	59.9	47.9	40.0	30.4	23.2	15.5	6.5	2.5	1.6
B			-	97.1	94.9	91.0	84.9	76.7	43.3	7.3	1.7
(partial B)					100.0	95.9	89.5	80.8	45.6	7.7	1.8

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 51%	Sound Lithotypes 49 %
soft sandstone 48; chert 2; friable granite 1	quartzite 14; hard sandstone 11; felsic intrusive 4; quartz 4; greywacke 3; argillite 3; hard metasedimentary 3; gneiss 3; hornfels 2; mafic extrusive 1; hard siltstone 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Very limited

LOCATION #: I12-16A (cont'd)

The esker segment within the pit area is nearing depletion. The vegetation in this area effectively masks this deposit on the aerial photographs. Consequently, similar unnoted deposits may be present in this general area. Since the quality of the material is fairly good for the area, such deposits, if present, could constitute local sources of fair quality aggregate.

LOCATION #: I12-16B NTS: 21 I/12

Type of Deposit: Outwash County: Northumberland

Exposure Type: Pit Parish: Rogersville

Status: Abandoned UTM: 063 783

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material; silty.

0.8 m Sandy Gravel: Poorly sorted, apparently massive, very fine to very coarse cobbly gravel, with occasional small boulders; the matrix consists predominantly of medium to very coarse sand; clasts are subangular to subrounded, with moderate to heavy silt coatings; maximum observed clast size = 0.6 m; the sample was obtained from this unit, exclusive of the cobble and boulder fraction.

0.4 m Gravelly Sand: Medium to coarse sand with generally fine gravel; no stratification is evident.

0.5 m Slump Covered: Appears to material as above.

The extent of this deposit cannot be readily determined. However, till is present to the south of the pit, and boggy areas to the east. Consequently, reserves are considered to be limited.

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	77.2	53.4	47.8	37.0	28.7	21.1	15.0	9.	5.9	3.7	2.8

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 76 %

soft sandstone 67; chert 5; slate 2; friable granite 1; soft metasedimentary 1

Sound Lithotypes 24 %

quartzite 8; hard sandstone 4; felsic intrusive 3; gneiss 3; argillite 2; hornfels 2; greywacke 1; quartz 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Limited

LOCATION #: I12-17 NTS: 21 I/12

Type of Deposit: Outwash County: Northumberland

Exposure Type: Pit Parish: Rogersville

Status: Active on demand (lightly) UTM: 072 787

SECTION DESCRIPTION & COMMENTS:

0.3 m Overburden: Soil development on the underlying material; silty.

1.4 m Sandy Gravel: Crudely cross-bedded medium to very coarse sand and very fine to coarse gravel; some beds consist of gravelly sand; beds dip eastwards; clasts are subangular to subrounded, with light to moderate silt coatings; maximum observed clast size = 0.2 m.

0.9 m Slump Covered: Assumed to be material as above; the base of the pit is locally wet; clayey till is present within 1 m of the surface in the northern part of the pit area.

This pit is located in a generally boggy area along the Middle Branch Barnaby River. The extent of the deposit cannot be mapped, since most of it lies below the water table, with only local higher areas lying above this level. Reserves in these individual areas are limited; D.O.T. (1967) estimated only about 3000 m^3 for the pit area. This is unfortunate, since the material is of good quality, having been recommended as suitable for base course usage by D.O.T. (1967; Los Angeles abrasion loss was 26.4%).

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	96.3	80.4	77.1	64.3	50.9	37.7	24.8	11.8	3.0	1.5	1.0
(partial)					100.0	74.1	48.7	23.2	5.9	2.9	2.0

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 29 %

soft sandstone 12; chert 5; schist 4; limonitic sandstone 4; friable granite 1; shale 1; soft metasedimentary 1; weathered 1

Sound Lithotypes 71 %

hard sandstone 20; quartzite 13; greywacke 11; gneiss 7; hard siltstone 5; hard metasedimentary 5; hornfels 3; quartz 3; felsic intrusive 2; mafic extrusive 2

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Limited at any one location

LOCATION #: I12-18 NTS: 21 I/12

Type of Deposit: Kame County: Northumberland

Exposure Type: Pit Parish: Blackville

Status: Inactive UTM: 885 587

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material.

1.1 m Sandy Gravel: Crudely stratified, predominantly medium to very coarse gravel, with a few cobbles and small boulders, and a matrix of predominantly medium to very coarse sand; clasts are subrounded to rounded, with light to moderate silt coatings; maximum observed clast size = 0.4 m.

1.5 m Slump Covered: Assumed to be material as above.

This tiny deposit is not readily evident in the aerial photographs. Consequently, similar unnoted deposits may be present throughout the map-area. However, available information indicates that such deposits would probably be of poor quality, and therefore of very limited aggregate potential.

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	92.1	60.4	52.0	34.8	24.8	17.9	13.4	9.1	4.8	2.3	1.3

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 90%

soft sandstone 90

Sound Lithotypes 10 %

quartzite 4; hornfels 2; felsic extrusive 1; mafic extrusive 1; gneiss 1; quartz 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Largely depleted (~500 m^3 remaining)

LOCATION #: I12-19 NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Roadcut Parish: Blackville

Status: Undeveloped UTM: 863 533

SECTION DESCRIPTION & COMMENTS:

0.3 m Overburden: Soil development on the underlying material; silty.

1.1 m Sand: Interbedded fine to medium sand, and medium to coarse sand with minor small pebbles; palaeoflow direction was towards the north.

0.3 m Sand: Laminated fine to medium sand; also dips northwards.

The pebbles in this deposit are generally subrounded. The maximum observed clast size was 10 cm.

This small esker segment appears to consist predominantly of sand. Reserves are limited due to the small size of the deposit; however, it might comprise a local source for fine concrete aggregate.

MECHANICAL ANALYSIS:

sieve		25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing			-	97.5	95.8	92.9	85.6	64.8	17.5	1.7	0.3

LITHOLOGIC ANALYSIS: N.A.

Unsound Lithotypes %	Sound Lithotypes %

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
			Limited

LOCATION #: I12-20 NTS: 21 I/12

Type of Deposit: Esker County: Northumberland

Exposure Type: Roadcut Parish: Blackville

Status: Undeveloped UTM: 915 552

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material; slightly silty.

0.7 m Sand: Cross-stratified medium to coarse sand, with a few small pebbles; palaeoflow was towards the northeast; Sample A was obtained form this unit.

0.7 m Sandy Gravel: Poorly sorted medium to very coarse gravel, with numerous cobbles, and a matrix of predominantly medium to coarse sand; clasts are subrounded to well rounded, with light silt coatings; maximum observed clast size = 0.2 m.

The height of the esker at this site is approximately 3 to 4 m. The length of this segment is only a few hundred metres; consequently, reserves are limited.

To the east, adjacent to Chain Meadow Brook, another esker segment, and associated fan, is present. Limited roadcut exposures in this area exhibit sandy gravel through to cobbly sandy gravel. Since the clasts

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MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing											
A				-	99.0	95.6	80.9	40.2	8.4	4.0	3.0
B	86.6	62.5	54.5	40.1	33.0	28.0	23.8	15.1	7.4	4.7	3.1

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 95 %	Sound Lithotypes 5 %
soft sandstone 94: weathered 1	hard sandstone 3; felsic intrusive 1; greywacke 1

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
I12-20 Limited			Limited
Along Chain Meadow Brook 15	15	2	300,000

LOCATION #: I12-20 (cont'd)

consist predominantly of local sandstone, the quality of the material will be poor, suitable only for borrow usage.

LOCATION #: I12-21 NTS: 21 I/12

Type of Deposit: Esker County: Kent

Exposure Type: Trench Parish: Huskisson

Status: Undeveloped UTM: 042 615

SECTION DESCRIPTION & COMMENTS:

0.4 m Overburden: Soil development on the underlying material.

1.3 m Sand and/or Gravel: Variable sandy gravel through to gravelly sand, commonly silty, and with numerous cobbles and small boulders; gravel predominates over sand; both the sand and the gravel components vary from fine to very coarse; clasts are subrounded to well-rounded, with light to moderate silt coatings; maximum observed clast size = 0.6 m.

The height of the esker is approximately 3.5 m at this site; the crest height of the segment varies from approximately 1 to 4 m. This deposit appears to consist predominantly of poor quality aggregate, suitable only for borrow usage.

MECHANICAL ANALYSIS:

sieve	50 mm	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
% passing	80.8	61.3	56.3	44.7	35.7	28.5	22.7	17.0	11.6	8.5	6.2

LITHOLOGIC ANALYSIS:

Unsound Lithotypes 97 %	Sound Lithotypes 3 %
soft sandstone 96; weathered 1	quartzite 3

ESTIMATION OF RESERVES:

total deposit area (hectares)	area workable (hectares)	average thickness (metres)	recoverable reserves (m^3) probable
8	6	1.5	90,000